TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

REMEDIATION METHOD FOR TANK 241-Z-361 SLUDGE

Identification No.: RL-02-22-NM

Date: October 2001

Program: Plutonium Finishing Plant

OPS Office/Site: Richland Operations Office/Hanford Site

PBS No.: RL-CP03

Waste Stream: Tank 241-Z-361 Sludge

TSD Title: N/A

Operable Unit (if applicable): N/A

Waste Management Unit (if applicable): N/A Facility: Plutonium Finishing Plant (PFP)

Priority Rating:

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" Priority.

X	1.	Critical to the success of the ACPC
		Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost
		savings or risk reduction, increased likelihood of compliance, increased assurance to
		avoid schedule delays)
	3.	Provides opportunities for significant, but lower cost savings or risk reduction, and
		may reduce uncertainty in ACPC project success.

Need Title: Remediation Method for Tank 241-Z-361 Sludge.

Need/Opportunity Category: Technology Need -- There is no currently identified technology that has been demonstrated to be capable of solving the site's problem in a cost-effective manner.

Need Description: Tank Z-361 is located at the Plutonium Finishing Plant (PFP) and is part of the PFP cleanout efforts. This underground settling tank contains legacy sludge resulting from waste discharges from past missions at PFP. There are approximately 67 cubic meters (18,000 gallons) of settled sludge, including about 25 kilograms of plutonium 239 (30 kg total fissile isotopes) currently in the tank. The tank also contains polychlorinated biphenyls (PCBs) of regulatory significance (>50 ppm on two of the samples). The tank is over 50 years old, and video inspection indicates its interior is somewhat degraded. As legacy waste, the remediation of the tank and sludge falls under regulation by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The project is faced with continued safe storage of the sludge in Tank Z-361 and, if required, elimination or reduction to acceptable levels of the threat of release of sludge from the tank. The current situation remains an issue of concern to the regulators and to the public; therefore, there is a need to demonstrate selected remediation

technologies and to determine the most appropriate remediation method for this sludge. The technology used for Z-361 may also be directly applicable to several other similar tanks at the Hanford site.

Schedule Requirements:

Earliest Date Required: 10/01/01 Latest Date Required: 6/30/02

The need dates above are based on coordination with the planned Engineering Evaluation/Cost Analysis (EE/CA) for Tank Z-361, as required under CERCLA. The EE/CA for Z-361 is currently planned for fiscal year 2002 and a baseline change request is being prepared to formalize this plan. The EE/CA is equivalent to the conceptual design phase under conventional project nomenclature, so this is the appropriate time for technology demonstrations necessary to confirm the project path forward and generate cost estimates of acceptable accuracy.

Problem Description: Tank 241-Z-361 is an inactive, rectangular underground tank used as a settling tank to receive low-salt (caustic), liquid effluent from PFP processes from 1949 to May 1973. After 1973, the supernatant liquid was pumped from the tank, leaving about 67 cubic meters of sludge in the tank. A disposal pathway needs to be selected that best addresses the goal of alleviating the health and environmental risks of the tank and its contents.

Potential Life-Cycle Cost Savings of Need (in \$000s) and Cost Savings Explanation: The cost estimate in the current MYWP baseline for remediation of Z-361 was prepared in 1999, before complete characterization data were available. The baseline plan is to pump small quantities of the sludge out of the tank, mix it with grout, and pump it into small containers for criticality control. The estimate is quite conservative, as the strict controls for flammable gas hazards and criticality prevention in effect at the time were assumed, based on the information then available. Strict controls for prevention of alpha contamination are also incorporated, and a high frequency of sampling and analysis is assumed. The approach is of necessity very slow and laborintensive. The estimated cost using this approach is \$25 million. This estimate was obtained using analogies with other Hanford work, with some bottoms-up detail used to implement the assumptions made.

More recent order of magnitude estimates have incorporated characterization data that indicate the absence of flammable gas in the tank headspace and the extremely low likelihood of criticality. They have also allowed for the use of a commercial remediation contractor with applicable specialized experience and equipment. One very promising remediation technology is in situ vitrification (ISV), and some estimates have been prepared assuming that ISV is selected as the remediation technology. This enabled the use of budget estimates from the ISV vendor, as well as the assumption that minimal site modifications would be necessary, since a new, "permanent" facility would not be required. It also enabled the assumption that the vitrified block would be left in place. Estimates done in this manner indicate project costs on the order of \$10 million. The estimates involve a mix of methods based on analogies with similar work.

The potential savings using ISV technology and current information therefore appear to be on the order of \$10 to \$15 million. At this early stage of the project, before conceptual design has been performed, estimates are of necessity on the order of $\pm 50\%$.

Benefit to the Project Baseline of Filling Need: Benefits to the Z-361 project from filling the need for demonstration of remediation technology are as follows:

- Reduction in schedule vs. baseline; as an expedited response under CERCLA, demonstration of progress is important.
- Reduction of personnel exposure due to elimination of removal of sludge from tank
- Confirmation of safe process operation with surrogate materials
- Acceptance of remediation process by client and upper management

Relevant PBS Milestones: This technology need is associated with PBS Milestone Number TRP-14-401, "Complete PFP Deactivation," due September 30, 2016, and with TRP-14-501, "Complete PFP Yard Cleanup/Demolition," due December 31, 2014.

Functional Performance Requirements: The Z-361 sludge may be contact handled; however, human entry into Z-361 is prohibited. Tank Z-361 is constructed of reinforced concrete, and is a rectangular underground structure, 26 feet long, 13 feet wide and varying in depth from 17 feet at the inlet end to 18 feet at the outlet end.

The sludge in Tank Z-361, which is from wastewaters generated in PFP, was laid down in layers; consequently, there is considerable variability in its characteristics from layer to layer. The overall results indicate the following characteristics: 1) meets transuranic (TRU) mixed waste designation criteria (contains about 20,000 nCi/g TRU and toxic heavy metals), 2) is considered PCB-containing waste (>50 ppm PCB on two samples), 3) contains approximately 25 kilograms of plutonium 239 (about 30 kg of total fissile isotopes), 4) consists of about 70 m³ of sludge with some debris items, 5) has consistency of peanut butter or toothpaste and 6) is about 70% water. Significant amounts of highly reactive or combustible materials were not detected during sampling or analysis and thus are not expected.

Although the potential hazards associated with Z-361 do not appear to be nearly as serious as was hypothesized when the tank was first identified as a potential problem in 1997, two characteristics of the tank contents – the plutonium and the PCBs – are limiting factors in selecting appropriate remedial action.

Work Breakdown TIP No.:

Structure (WBS) No.:

3.03.03.05.05.01 N/A

The Z-361 project is under Hanford WBS number 1.4.5.1.15.14.2.1, "Conduct Safe and Stable Actions for Other Yard Areas."

Justification For Need:

Technical: The PFP Project cleanout efforts require remediation of the sludge.

Regulatory: The sludge in Tank Z-361 must be remediated in accordance with CERCLA. The U.S. Environmental Protection Agency has determined that the tank will be remediated as a non-time-critical removal action. There are also likely to be TPA milestones in the future for selected activities on remediation of Z-361.

Environmental Safety & Health: There will be a significant potential for exposure to alpha contamination with any remediation solution that requires removal of the sludge from the tank, whether for treatment, storage or final disposal. During the history of ISV development, there have been a few safety-related incidents. Demonstration of the safety performance of current vitrification techniques is needed in order to gain acceptance from the customer, contractor management and PFP staff.

Cultural/Stakeholder Concerns: Tank Z-361 sludge is an issue of concern to the regulators and the public. Status and plans for the tank have been on the agenda of the Hanford Advisory Board several times since the tank was first identified as a potential hazard in 1997.

Other: None identified.

Current Baseline Technology: Five end-state alternatives have been defined and assessed for remediation of the sludge in Tank Z-361; 1) dispose in place, 2) remove, treat, and dispose at WIPP, 3) remove and place in interim storage, 4) remove, process and dispose at ERDF, and 5) send to tank farms for processing with high-level waste sludges. Technologies for sludge removal (sluicing, mechanical) and for grouting wastes are well established, and demonstration is not expected to be necessary. However, ISV is not as mature or widely accepted as these other technologies, and there are safety concerns, which would be alleviated by a successful demonstration.

End-User: Technology for remediation of Tank Z-361 will be implemented by the Nuclear Material Stabilization Project.

Contractor Facility / Project Manager: The contractor responsible for the Nuclear Material Stabilization Project is Fluor Hanford, Inc. (FH).

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